Nation's CEOs say U.S. may lose its R&D lead

THE UNITED STATES, while currently leading the world in research and development, is losing ground to other nations and may no longer be the world's technology leader by the year 2000.

But instead of stepping up their R&D efforts to combat this decline, U.S. corporations likely will reduce the rate of growth in their research activities over the next three years, preferring to take short-term profits over long-term gains.

Those are among the major findings of an *R&D* magazine opinion poll of chief executive officers at the nation's 476 largest industrial companies. Some of the study's findings reinforce those of an *R&D* survey of scientists conducted this past February.

At the same time, the new survey points out significant differences between how research scientists and industrial executives view U.S. technological competitiveness.

The CEO mail survey, conducted in June and July, resulted in a 26% response rate, considered by statisticians to be projectable to the universe of 476 companies at the 95% confidence level, with an error of ±10%.

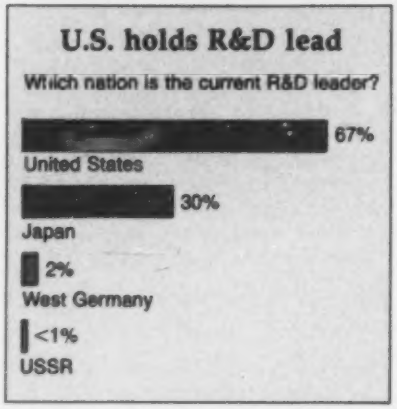
A gradual decline

Most of the nation's top industrial CEOs (67%) perceive the U.S. to be the current technological leader in the world. Another 30% see Japan as being ahead of the U.S., with a smattering of support for West Germany (2%) and the USSR (less than 1%).

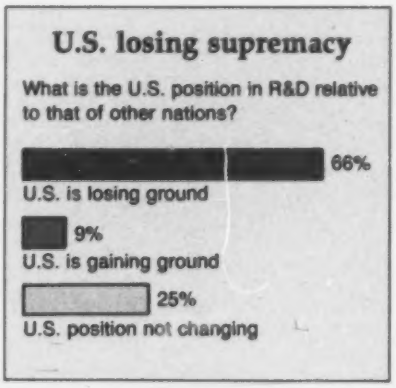
This view contrasts sharply with that of the 500 scientists surveyed earlier by *R&D*. In that study, the U.S. and Japan were seen by the scientific community as locked in a virtual tie, with 48% of the scientists stating the U.S. was ahead, compared to 46% who said Japan was leading. "Perhaps scientists and researchers, being closer to the R&D situation, are more aware of the technology gap," said *R&D* publisher Timothy M. Kelly.

While they are more sanguine than scientists about the U.S.'s current status, a greater proportion of CEOs (66%) said they believe the U.S. is losing ground in technology to other developed nations, compared to 49% of scientists who said U.S. leadership is slipping.

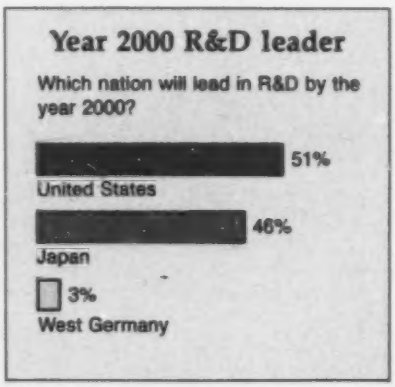
Only 9% of CEOs said the U.S. is gaining ground against other countries, *vs* 14% of scientists surveyed. A fourth of the CEOs feel that the U.S. position is not changing relative to that of other nations, compared to a third of scientists.



Two thirds of CEOs in the R&D *poll say the U.S. leads the world in technology.*



Nearly two out of three CEOs say the U.S. is losing ground in R&D to others.



Most CEOs foresee the U.S. and Japan neck-and-neck in R&D by the year 2000.

Too close to call

Corporate executives predict that by the end of the century the U.S. will still be on top of the world in technology, but only by a slim margin, 51% *vs* 47% for Japan. The results are so close that it is impossible to say, from the study alone, which nation more CEOs believe will be the leader.

In the survey of scientists, however, the response was more clear-cut. By the year 2000, Japan will be the leader, according to 52% of scientists polled, compared to 38% who said the U.S. will retain that position.

"There may be slight differences between the responses of the two groups, with the CEOs a little more optimistic about the U.S. situation today," said Kelly. "But the trend is obvious. Both CEOs and scientists see the U.S. losing the lead, and Japan moving up. That's not a good sign."

Research and development plays a strategic role in 9 of 10 industrial companies, according to the survey. A majority of CEOs (56%) said R&D is "very important" to the strategic planning process in their companies, with another 34% saying it was "somewhat important."

The majority of U.S. industrial companies seems to be backing that philosophy with action. Almost two thirds of CEOs responding (65%) report an increase in R&D activity at their companies from 1985 to 1987. Only 10% tell of a decline. A fourth say their R&D activity has stayed about the same.

Looking ahead to the next three years, a smaller proportion of CEOs, about 59%, predict that R&D activity at their companies will increase, while 34% said that it will stay about the same. Although only 3% said that R&D at their companies will decline, another 4% are not sure where it will be going in the short term.

But, when asked to give some mea-

sure of the change in R&D activity for both the previous and coming three-year periods, CEOs indicated a likely reduction in the rate of growth of R&D activity in the near future.

From 1985 to 1987, the average increase for all industrial firms was estimated at between 10 and 22%, with an average increase of nearly 16% for the three-year period. Asked to predict the level of R&D activity over the next three years, however, CEOs said the level will increase between 7 and 15%, averaging only about 11%.

"Based on this forecast, we probably will be facing a relative decline in the growth of industrial R&D activity, especially when you consider the effect of inflation," said Kelly.

To get further insight into the thinking behind these plans, the CEOs were asked their reactions to this statement: "U.S. companies generally have a short-term view of research and development, sacrificing long-term gains for short-term profits."

More than three fourths of all respondents agree (60%) or agree strongly (16%) with that statement. Only 4% disagree strongly with it, while another 19% merely disagree.

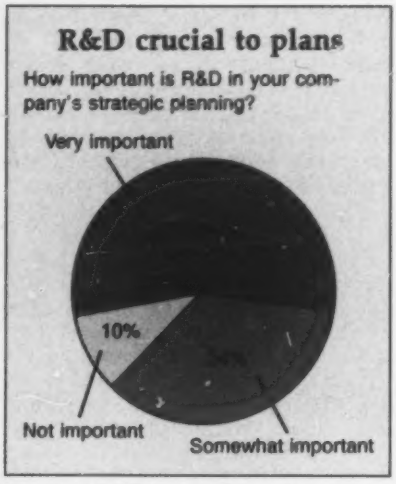
Intense pressure

"Even though we didn't ask the CEOs if this was the case at their own companies, it's apparent that executives of the nation's top industrial companies are under intense pressure to produce immediate results to please shareholders," said Kelly. "The need to boost stock prices and ward off takeover attempts apparently is causing them to trim R&D spending."

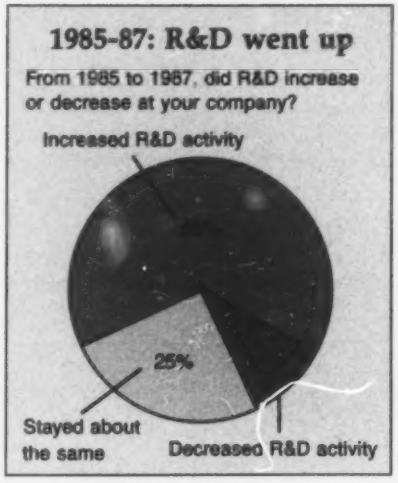
As to *how* research and development should be done, there is virtually no consensus among U.S. industrial firms. Roughly equal percentages of U.S. companies are further centralizing (18%) or decentralizing (20%) their R&D efforts. Among firms that say they are "staying about the same," 33% are "mostly centralized" and 30% are "mostly decentralized."

"There doesn't seem to be any dominant school of thinking on this," said Kelly. "Apparently it varies from company to company and from industry to industry."

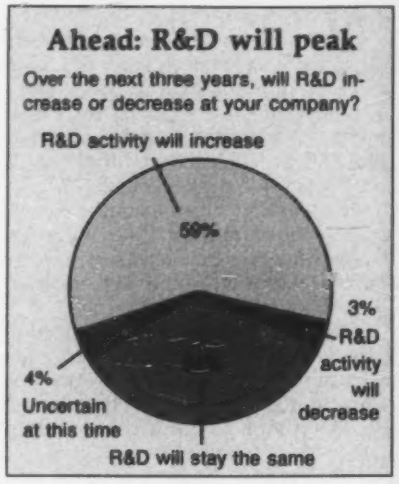
Based on the overall findings of the survey, most CEOs probably would agree with the respondent who wrote that, from a technological standpoint, "we are losing the edge." Another CEO clarified that point by saying, "The U.S. suffers from a deficiency



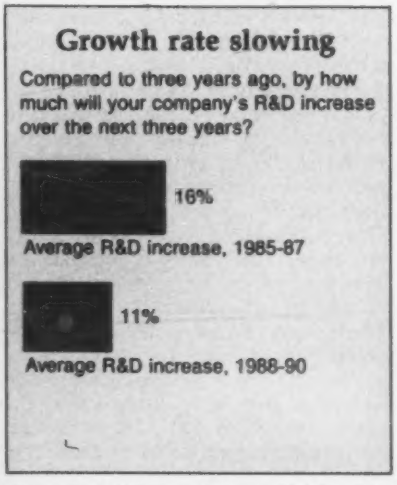
More than 90% of CEOs say R&D plays a role in their corporate plans.


1985-87: R&D went up
From 1985 to 1987, did R&D increase or decrease at your company?
Increased R&D activity
25%
Stayed about the same
Decreased R&D activity

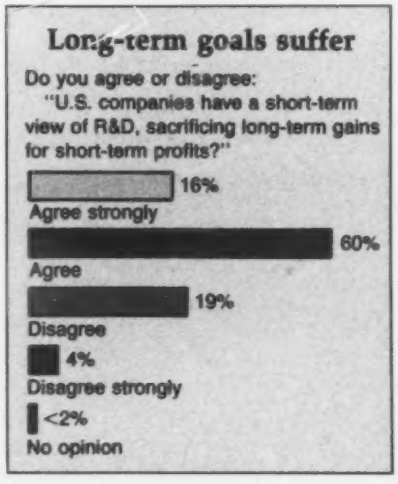
About two thirds of CEOs say their R&D had increased from 1985 to 1987.


Ahead: R&D will peak
Over the next three years, will R&D increase or decrease at your company?
R&D activity will increase
59%
3%
R&D activity will decrease
4%
Uncertain at this time
R&D will stay the same

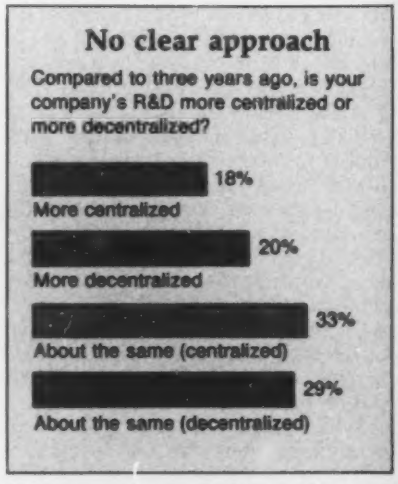
Fewer CEOs foresee their R&D activity increasing in the near future.


Growth rate slowing
Compared to three years ago, by how much will your company's R&D increase over the next three years?
16%
Average R&D increase, 1985-87
11%
Average R&D increase, 1988-90

Growth in R&D activity will fall off in the next three years, CEOs predict.



Most CEOs say U.S. companies sacrifice long-term for short-term gains.



U.S. companies use both centralized and decentralized R&D, CEOs say.

in development rather than in basic research."

Yet there were some who, despite the pessimistic tone of the findings, offer a positive view of the future. "The U.S. lost some, but not all, of its previous advantage in R&D and now is awakened and starting to recover," said one CEO.

Added another chief executive, "My optimistic response presumes that this nation—government, industry, and academia—will rise to the challenge of reversing current negative trends in our own competitiveness." □

Can Intel's Noyce get Sematech rolling?

FROM SILICON VALLEY to Boston's high-tech corridor, the semiconductor business in August breathed a sigh of relief with the announcement that Sematech, the industry's research group, had a CEO.

And not just any CEO, but Robert N. Noyce, vice chairman and co-founder of Intel Corp., co-inventor of the integrated circuit, and one of the most highly respected people in the field.

As Sematech founder Charles E. Sporck, president of National Semiconductor Corp., put it, "I'm ecstatic. The ideal guy with the greatest stature in the industry is head of Sematech."

The appointment of Noyce, 60, and IBM executive Paul P. Castrucci, 54, as chief operating officer came after an exhaustive year-long search by Sporck, Noyce, and W.J. Sanders III, chairman of Advanced Micro Devices Inc. More than 200 applicants were interviewed.

"The people who wanted the job were not acceptable, and the people who were acceptable were happy where they were," Noyce told *R&D* in a phone interview. "It was like the Groucho Marx line—'I wouldn't join any club that would have me as a member.' We were aiming very high, and these people were right in the middle of their career development, on the fast track in their own companies, and they wanted to stay there."

At one point in its search, the committee almost snared Robert B. Palmer, manager of semiconductor operations for Digital Equipment Corp., and Gilbert F. Amelio, then president of Rockwell Intl.'s semiconductor program. But each of them turned the committee down when their companies made counteroffers.

Noyce said that he and Castrucci are "in a very different position, because we're coming to the end of our careers with our companies, and we're in much more of a position of not having to worry about future career moves." Both executives said they intend to relocate to Austin, TX, headquarters of Sematech. Castrucci will leave IBM, but Noyce will keep his title at Intel.

Tough job ahead

Now that the leadership question is settled, Noyce said his top priority will be to get full Federal funding for Sematech's second-year budget. Congress approved $100 million for the program last year, an amount the House has approved for the coming year as well. But the Senate appropriation calls for only $45 million.

"It would slow us down if we don't get the full amount, but we feel confident that we'll get it," said Noyce. "We believe we'll be able to correct the difference in funding in the conference committee, or it could be funded as a continuing resolution."

The rest of Sematech's $250-million annual budget comes from its 14 member corporations—IBM, Intel, DEC, AT&T, Texas Instruments, Motorola, National Semiconductor, Harris Corp., Rockwell Intl., NCR, LSI Logic Corp., Micron Technology, Advanced Micro Devices, and Hewlett-Packard.

Each company contributes 1% of sales, with a minimum of $1 million. The maximum for any company is 15% of the total corporate contribution, to prevent domination by a single corporation.

The executive team's second priority is, in Castrucci's terms, to make Sematech "the West Point of manufacturing" by attracting the best and the brightest in the industry to Austin. The staff will be beefed up from the current 135 to about 250 by year-end, then doubled again in 1989.

"We're trying to shoot pretty high" in the quality of hires, said Noyce.

The real challenge will be to develop new manufacturing processes for the semiconductor industry—to, in Noyce's words, "reverse the downward trend and make this the premier industry in the world."

When Sematech was being formed, Noyce's company, Intel, wanted the consortium to actually manufacture chips in competition with the Japanese—a work program that was rejected by the group's architects.

The five-year plan is for Sematech to develop advanced semiconductor manufacturing processes, materials, and equipment at the consortium's 300,000-ft² facility, which should be ready for occupancy later this year.

One research option will be to come up with ways to increase productivity by making chips on 8-in. wafers instead of the 5-in. ones currently used and to find manufacturing techniques to cut the size of chips in half.

Once these innovations have been proven, they will be transferred to the consortium's members for use in commercial applications.

Need for cooperation

An industry-wide approach is necessary, said Noyce, to reverse the trend begun by the Japanese in the mid-1970s, when they launched a $400-million government-sponsored R&D program targeting very large scale integration (VLSI) semiconductor technology—an initiative that allowed the Japanese to go on to dominate the memory-chip market.

"As long as we were competing against the Japanese as individual companies, we were beating them, but when they were able to work together, they were able to change that situation," said Noyce. "They got their companies together then for the same reason we're doing it now, because they had been beaten."

Noyce feels that Sematech can rise to the challenge, even if some critics of the program label it a huge gamble. "I don't think it's a crap shoot," he said. "There is a problem in that we're putting people together from 14 different corporate cultures, and things are going to have to settle down before we have a Sematech culture."

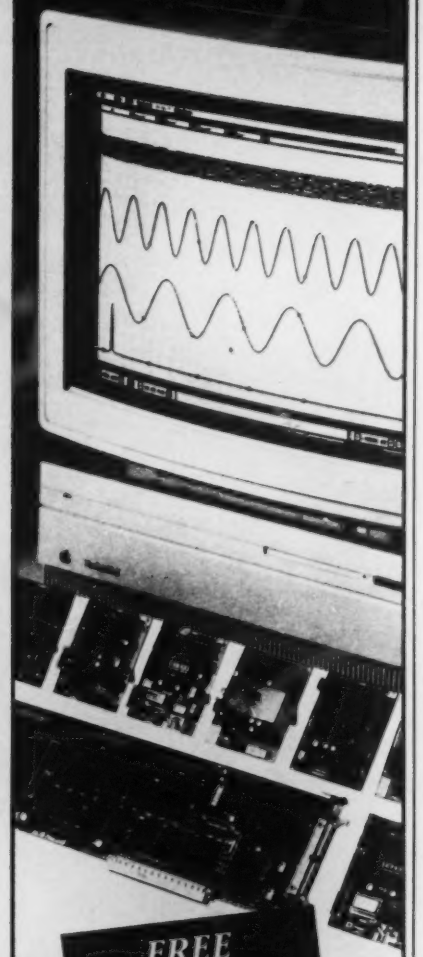
But, said Noyce, "even if we don't succeed in achieving our full objectives, Sematech will still have a big effect on the industry."

—Robert Cassidy

Sematech CEO Noyce: Will he be able to turn the semiconductor industry around?

DATA ACQUISITION ON THE MACINTOSH

Advanced hardware and software solutions for all Macintosh computers



FREE CATALOG
Write or call to talk to a GW Engineer
617-625-4096

GW Instruments, Inc.
35 Medford St. • Somerville, MA 02143

The Macintosh Data Acquisition Company

For information circle **266**

R&D

Timothy M. Kelly
Vice President and Publisher
Linda Salz, Advertising Contracts
1350 E. Touhy Ave., Box 5080
Des Plaines, IL 60017-5080
312/635-8800

Advertising Sales Offices

NEW ENGLAND, QUEBEC
Richard A. Groth Jr.
199 Wells Ave., Newton, MA 02159
617/964-3730

NORTHERN NEW JERSEY AND LONG ISLAND, NEW YORK
Dixon M. Raymond
718 Hillcrest Rd.
Ridgewood, NJ 07450
201/447-3064

NEW YORK CITY, EASTERN NEW YORK STATE, MID-ATLANTIC, SOUTHEAST
Larry Hookey
1873 Route 70 East, Suite 302
Cherry Hill, NJ 08003
609/751-0170

WESTERN NEW YORK, ONTARIO, OHIO, WESTERN PENNSYLVANIA, EASTERN MICHIGAN, KENTUCKY, WEST VIRGINIA
Larry Violand
1621 Euclid Ave., Suite 1530
Cleveland, OH 44115
216/696-1800

MIDWEST
James M. Langhenry
1350 E. Touhy Ave., Box 5080
Des Plaines, IL 60017-5080
312/635-8800

SOUTHERN CALIFORNIA, COLORADO, NEVADA, UTAH, ARIZONA, NEW MEXICO, TEXAS, OKLAHOMA, ARKANSAS
John Bolduc
18818 Teller Ave., Suite 170
Irvine, CA 92715
714/851-9422

NORTHERN CALIFORNIA, NORTHWEST STATES, HAWAII, WESTERN CANADA
Michael C. Magee
3031 Tisch Way, Suite 100
San Jose, CA 95128-2593
408/243-8838

EUROPE
Edward Reuteler Jr.
Managing Director
27 Paul Street
London EC2A 4JU England
44-1-628-7030

JAPAN
Kaoru Hara
Dynaco International Inc.
Suite 1003, Sun-Palace Shinjuku
8-12-1 Nishishinjuku Shinjuku-ku
Tokyo 160, Japan
03-366-8301

Cahners Publishing Company

Terrence M. McDermott, President
Robert T. Brawn, Group V.P.

Research & Development (ISSN 0746-9179) is published monthly except semi-monthly in March by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158-1630. Terrence M. McDermott, President; Robert T. Brawn, Group Vice President; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing.; Timothy M. Kelly, Vice President and Publisher; Neil P. Ruzic, founder of *Industrial Research*.

Circulation records are maintained at Cahners Publishing Company, 44 Cook St., Denver, CO 80206-5800 (Phone: 303/388-4511). **Circulation:** More than 115,000 copies distributed. Second-class postage paid at Denver, CO 80206-5800, and at additional mailing offices. **Postmaster:** Send address corrections to *Research & Development* at our Denver address.

Subscriptions: Annual subscription rates for non-qualified people: USA, 1 yr $40; Canada, Mexico, and foreign via surface mail, 1 yr $55; foreign via air mail, 1 yr $100. Except for special issues where price changes are indicated, single copies of regular issues are available for $10. Please address all subscription mail to *Research & Development*, 44 Cook St., Denver, CO 80206-5800. Include zip code and—for change of address—copy of old label.

Research & Development copyright 1988 by Reed Publishing USA; Saul Goldweitz, Chairman; Ronald G. Segel, President and Chief Executive Officer; Robert L. Krakoff, Executive Vice President; William M. Platt, Senior Vice President.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage retrieval system, without written permission of the copyright owner. Prices for bulk reprints of articles available on request. Copies of back issues are available from University Microfilm, 300 N. Zeeb Rd., Ann Arbor, MI 48106, and on microfiche from Micro-Photo Div., Bell & Howell, Old Mansfield Rd., Wooster, OH 44691. *Research & Development* articles are indexed in Engineering Index, Current Contents, and New York Times Information Bank.

Cahners Publishing Company, A Division of Reed Publishing USA □ Specialized Business Magazines for Building & Construction □ Manufacturing □ Foodservice & Lodging □ Electronics & Computers □ Interior Design □ Printing □ Publishing □ Industrial Research & Technology □ Health Care □ Entertainment □ Specialized Consumer Magazines: American Baby □ Modern Bride.

ABP BPA ABC